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Evaluation Board for the ADF4150HV PLL Frequency Synthesizer

FEATURES

- General-purpose evaluation board for ADF4150HV, including octave range VCO, loop filter and TCXO
- Contains the ADF4150HV frequency synthesizer (500 MHz to 3 GHz)
- Contains the ADF5001 prescaler to allow optional connection of external microwave VCOs without need for an active loop filter
- Accompanying software allows complete control of synthesizer functions from a PC

EVALUATION KIT CONTENTS

- EVAL-ADF4150HVEB1Z board
- CD that includes
  - Self-installing software that allows users to control the board and exercise all functions of the device
  - Electronic version of the ADF4150HV data sheet
  - Electronic version of the UG-406 user guide

ADDITIONAL EQUIPMENT

- PC running Windows XP or more recent version
- Power supply
- Spectrum analyzer
- Oscilloscope (optional)

DOCUMENTS NEEDED

- ADF4150HV data sheet

REQUIRED SOFTWARE

- Analog Devices ADF4150HV software (Version 2 or higher)
- ADIsimPLL

GENERAL DESCRIPTION

This board is designed to allow the user to evaluate the performance of the ADF4150HV frequency synthesizer for phase-locked loops (PLLs). Figure 1 shows the board, which contains the ADF4150HV synthesizer, loop filter, voltage control oscillator (VCO) of 1 GHz to 2 GHz octave range and up to 28 V high tuning voltage, reference oscillator (TCXO) of 25 MHz frequency for the reference input, power supply connectors, and an RF output. The ADF5001 prescaler allows for optional direct connection of external microwave VCOs without the need for an active loop filter.

The evaluation kit also contains software that is compatible with Windows® XP and later versions to allow easy programming of the synthesizer.

A USB port in the PC is required to program the part.

EVALUATION BOARD

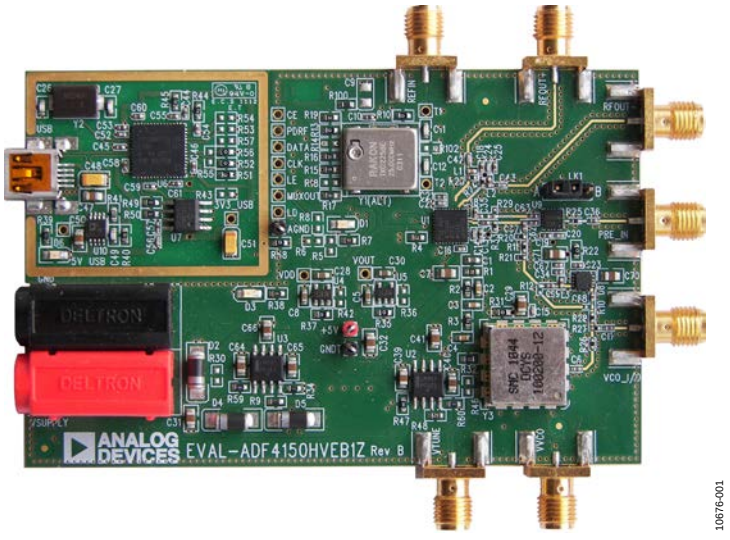

Figure 1. EVAL-ADF4150HVEB1Z

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REVISION HISTORY

5/12—Revision 0: Initial Version

QUICK START GUIDE

Follow these steps to quickly evaluate the ADF4150HV device:

1. Install the ADF4150HV software.
2. Connect the EVAL-ADF4150HVEB1Z board to the PC.
3. Follow the hardware driver installation procedure.
4. Connect the power supplies as follows:
   a. 30 V to banana connectors
   b. 5 V to the test point labeled +5V on the board
5. Run the ADF4150HV software.
6. Connect the spectrum analyzer to the SMA connector, VCO_I/O.
7. Measure the results.

EVALUATION BOARD HARDWARE

The EVAL-ADF4150HVEB1Z schematics are shown in Figure 25, Figure 26, Figure 27, and Figure 28. The silkscreen of the evaluation board is shown in Figure 2.

POWER SUPPLIES

There are two separate supply voltages required for the evaluation board.

- Banana connectors should be supplied with 30 V. This powers the LM317LDG regulator, which provides a regulated 29 V to V_P (the charge pump supply of the ADF4150HV) and 12 V for the DCYS100200-12 VCO supply (V_{VCO}).
- The test point labeled +5V must be supplied with 5 V, as shown in Figure 24. This powers high precision, low noise ADP150AUJZ-3.3 linear regulators to provide 3.3 V to V_{DD} on the board (which supplies the ADF4150HV AV_{DD}, DV_{DD} , and SDV_{DD} pins), to V_{OUT} (supply for the ADF4150HV RF outputs pull-up), and to the ADL5541 buffer, which improves PFD spur levels at the VCO output.

The D3 LED indicates when the ADF4150HV is powered.

INPUT SIGNALS

The reference signal is necessary for proper operation of the synthesizer. It can be sourced from a provided TCXO or from an external generator, which can be connected to the REFIN edge mount connector. To use an external reference generator, it is necessary to remove R101 and R100 to disconnect the TCXO from the reference input and from the supply. R102 can be populated with a 50 Ω resistor to adjust the impedance matching of the evaluation board to the external reference source.

Digital SPI signals are supplied from the Cypress microcontroller, U6, which is used for communication with the USB port of the PC.

OUTPUT SIGNALS

All components necessary for LO generation are inserted on the board. The PLL is made up of the ADF4150HV synthesizer, a fourth-order passive loop filter, and the octave range VCO. The loop filter is inserted between the charge pump output and the VCO input, as shown in Figure 28. If replacing the VCO, a VCO in a T-package (or similar) must be used. The VCO output is available at the edge mount SMA connector, VCO_I/O, and the differential RF output of the part is connected to the RFOUT+ and RFOUT– edge mount SMA connectors.

A buffer, the ADL5541, is placed between the VCO output and the ADF4150HV RF_{IN}+ pin, which significantly lowers the PFD spur levels seen at the VCO output below –110 dBc. If the PFD spur level measured on the VCO output without a buffer is sufficient (approximately –80 dBc) or if the output signal is taken only from the RF output pins of the ADF4150HV and not from the VCO ouput, the ADL5541 is not needed and can be bypassed.

The device is quite sensitive to impedance unbalance. If only one port of the differential pair is used, the other should be terminated with a 50 Ω load. The external VCO output should also be terminated in a 50 Ω load.

DEFAULT OPERATION SETTINGS

This board is shipped with a TCXO that provides a reference frequency of 25 MHz, a fourth-order low-pass filter with 20 kHz bandwidth at I_{CP} = 300 µA, and an octave range VCO with a 1 GHz to 2 GHz frequency range. To test the performance of the part for a different frequency range and different loop filter, the relevant components on the board must be changed.

Note that the Synergy VCO tuning sensitivity decreases as the tuning voltage increases (see Figure 3). To maintain a constant loop filter bandwidth, increase the charge pump value to the maximum of 400 µA for frequencies greater than approximately 1.8 GHz.

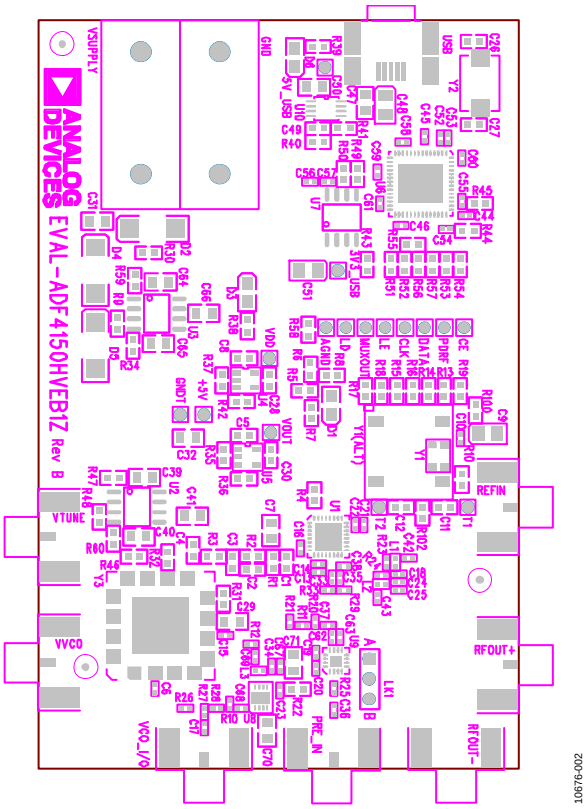

Figure 2. Evaluation Board Silkscreen

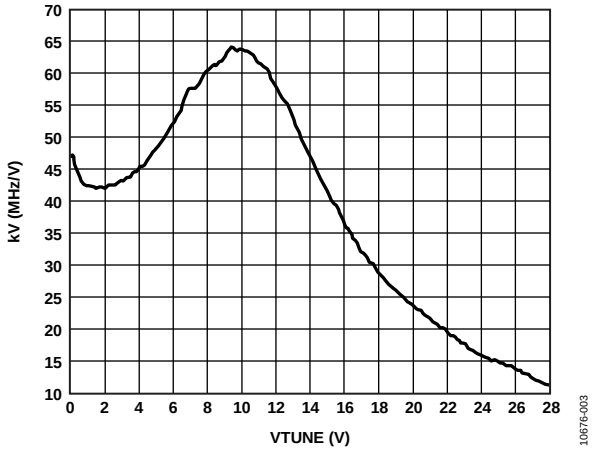

Figure 3. Frequency Gain vs. Tuning Voltage for DCYS100200-12 VCO

ADDITIONAL OPTIONS

The VVCO connector can be used as a test point to measure the supply voltage of the VCO in its default configuration. It can also be used to provide an external supply for the on-board VCO; however, if an external supply for VCO is used, Resistor R31 must be removed to disconnect the connector from the output of the on-board voltage regulator.

External VCO Option

Optionally, an external VCO can be used. In this case, it is necessary to remove R32 and insert a 0 Ω link at R46 to form a connection between the loop filter output and the VTUNE SMA edge mount connector. Remove R31 to disconnect the on-board VCO from the power supply. Remove Resistor R26 to disconnect the output of the on-board VCO from the RF signal path, and replace Resistors R27 and R28 with 0 Ω links to ensure operation of the VCO_I/O connector as an input from an external VCO.

Prescaler for Microwave VCO

The board contains the ADF5001, an 18 GHz divide-by-4 prescaler for users who want to interface a high frequency microwave VCO to the ADF4150HV. For example, using a 12 GHz external VCO, use the VTUNE SMA as described in the External VCO Option section, but, in this case, connect the VCO output to the PRE_IN SMA connector. The prescaler must be enabled by moving Jumper LK1 into Position B. The ADF4150HV should be programmed to accept a 12 GHz ÷ 4 frequency, or 3 GHz. Isolate the VCO tracks from the output of the prescaler by removing C37. It is recommended to interface the prescaler differentially for best performance; therefore, swap C38 (100 pF) into the space provided for C35. R33 can be removed as shown in Figure 4. Note the loop filter should be redesigned when changing the VCO and/or reference frequencies.

PHASE NOISE MEASUREMENT

With the default settings, in-band phase noise of close to −101 dBc/Hz can be measured. This translates to a normalized phase noise floor of −211 dBc/Hz. To measure the ADF4150HV normalized phase noise specification of −213 dBc/Hz, increase the loop bandwidth to 50 kHz or greater. The simplest way to do this is to change the RSET resistor (R4) to 3.3 kΩ. This increases the charge pump current from 400 µA to 618 µA with a corresponding increase in loop bandwidth. With the wider loop bandwidth, a phase noise of −103 dBc/Hz can be measured:

$$PN = -213 + 10\log(25\ \text{MHz}) + 20\log(1500/25) = -103\ \text{dBc/Hz}$$

The variation of phase noise vs. PLL loop bandwidth can be modeled in ADIsimPLL.

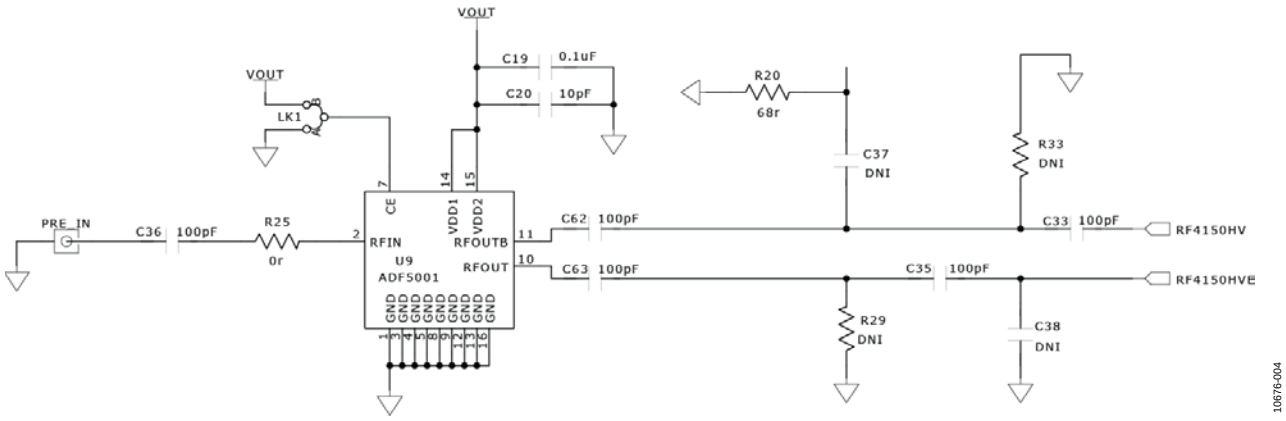

Figure 4. Configuration of the Board for External Microwave VCO Using the ADF5001 Prescaler

EVALUATION BOARD SETUP PROCEDURE

SOFTWARE INSTALLATION

Use the following steps to install the software.

1. Install the Analog Devices ADF4150HV software by double-clicking **ADF4150HV Setup.msi**.
   If you are using Windows XP, follow the instructions in the Windows XP Software Installation Guide section (see Figure 5 to Figure 9).
   If you are using Windows Vista or Windows 7, follow the instructions in the Windows Vista and Windows 7 Software Installation Guide section (see Figure 10 to Figure 14).
   Note that the software requires Microsoft Windows Installer and Microsoft .NET Framework 3.5 (or higher). The installer connects to the Internet and downloads Microsoft .NET Framework automatically. Alternatively, before running the **ADF4150HV Setup.msi**, both the installer and .NET Framework can be installed from the CD provided.
2. Connect your board by USB.
   If you are using Windows XP, follow the steps in the Windows XP Driver Installation Guide section (see Figure 15 to Figure 18).
   On Windows Vista or Windows 7, the drivers install automatically.

Windows XP Software Installation Guide

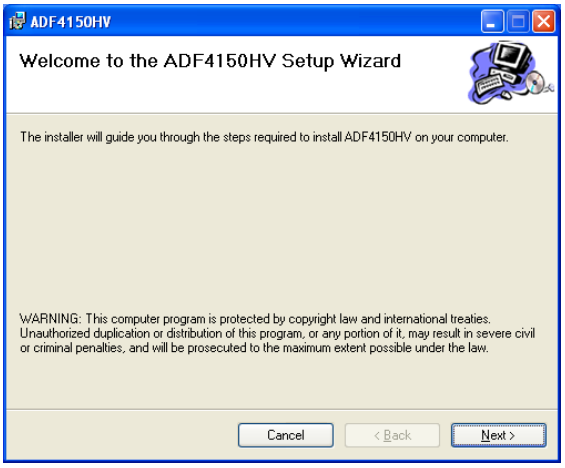
ADF4150HV
Welcome to the ADF4150HV Setup Wizard
The installer will guide you through the steps required to install ADF4150HV on your computer.
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.
Cancel
< Back
Next >
10676-005

Figure 5. Windows XP ADF4150HV Software Installation, Setup Wizard

1. Click **Next**.

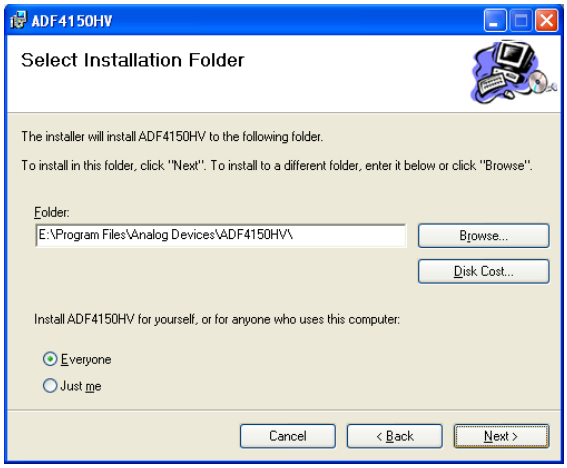
ADF4150HV
Select Installation Folder
The installer will install ADF4150HV to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Folder:
E:\Program Files\Analog Devices\ADF4150HV\
Browse...
Disk Cost...
Install ADF4150HV for yourself, or for anyone who uses this computer:
Everyone
Just me
Cancel
< Back
Next >
10676-006

Figure 6. Windows XP ADF4150HV Software Installation, Select Installation Folder

2. Choose an installation directory and click **Next.**

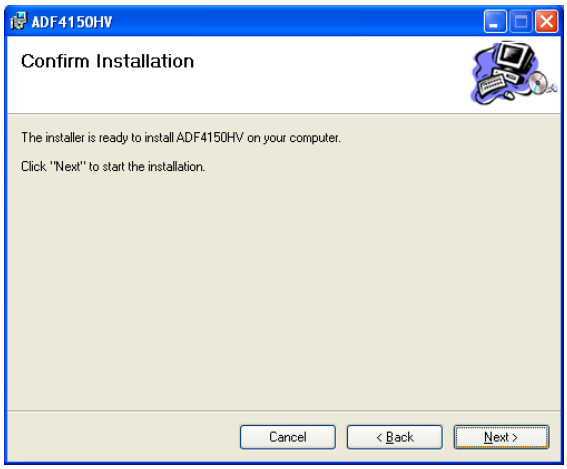

Figure 7. Windows XP ADF4150HV Software Installation, Confirm Installation

3. Click **Next.**

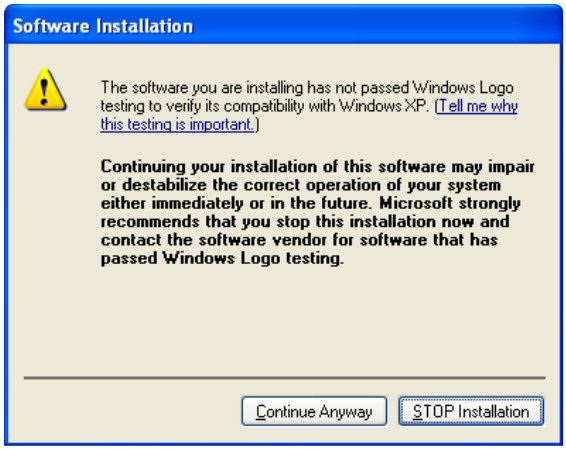
Software Installation
The software you are installing has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the software vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation
10676-008

Figure 8. Windows XP ADF4150HV Software Installation, Logo Testing

4. Click **Continue Anyway**.

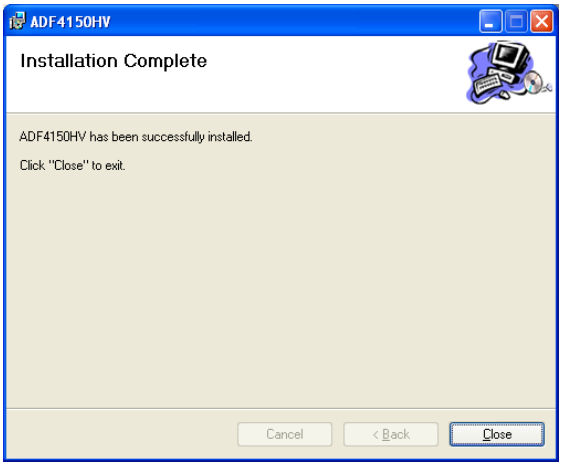

Figure 9. Windows XP ADF4150HV Software Installation, Installation Complete

5. Click **Close.**

Windows Vista and Windows 7 Software Installation Guide

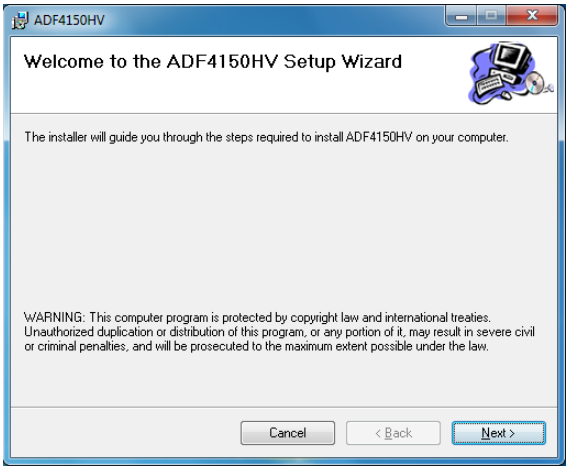
ADF4150HV
Welcome to the ADF4150HV Setup Wizard
The installer will guide you through the steps required to install ADF4150HV on your computer.
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.
Cancel
< Back
Next >
10676-010

Figure 10. Windows Vista/7 ADF4150HV Software Installation, Setup Wizard

1. Click **Next**.

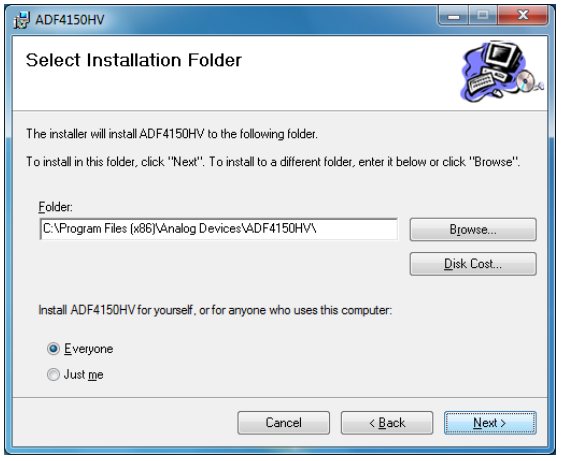
ADF4150HV
Select Installation Folder
The installer will install ADF4150HV to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Folder:
C:\Program Files (x86)\Analog Devices\ADF4150HV\
Browse...
Disk Cost...
Install ADF4150HV for yourself, or for anyone who uses this computer:
Everyone
Just me
Cancel
< Back
Next >
10676-011

Figure 11. Windows Vista/7 ADF4150HV Software Installation, Select Installation Folder

2. Choose an installation directory and click **Next.**

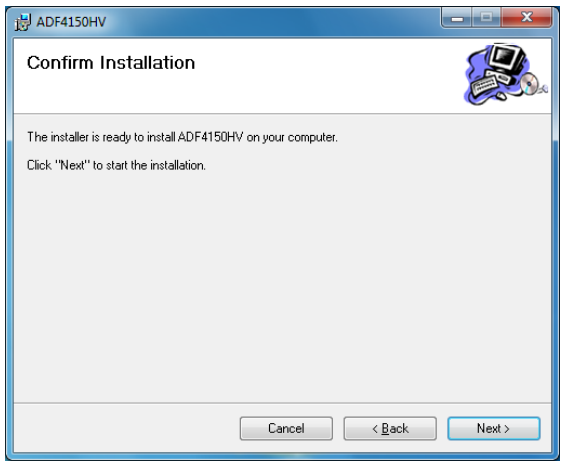

Figure 12. Windows Vista/7 ADF4150HV Software Installation, Confirm Installation

3. Click **Next**.

Windows Security
Would you like to install this device software?
Name: Analog Devices, Inc Universal Serial Bus...
Publisher: Analog Devices B.V.
Always trust software from "Analog Devices B.V.".
Install
Don't Install
You should only install driver software from publishers you trust. How can I decide which device software is safe to install?
10676-013

Figure 13. Windows Vista/7 ADF4150HV Software Installation, Start Installation

4. Click **Install**.

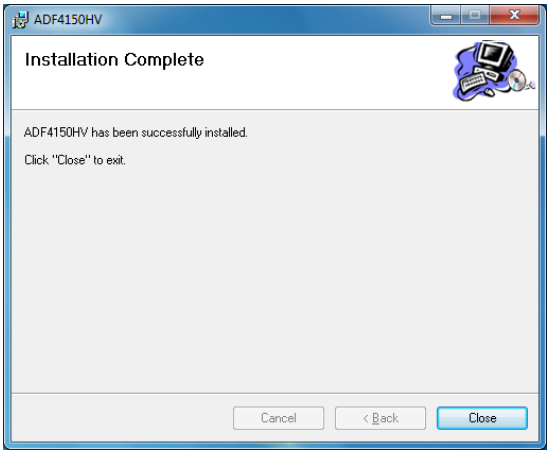

Figure 14. Windows Vista/7 ADF4150HV Software Installation, Installation Complete

5. Click **Close**.

Windows XP Driver Installation Guide

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel
10676-015

Figure 15. Windows XP USB Driver Installation, Found New Hardware Wizard

1. Choose **Yes, this time only** and click **Next**.

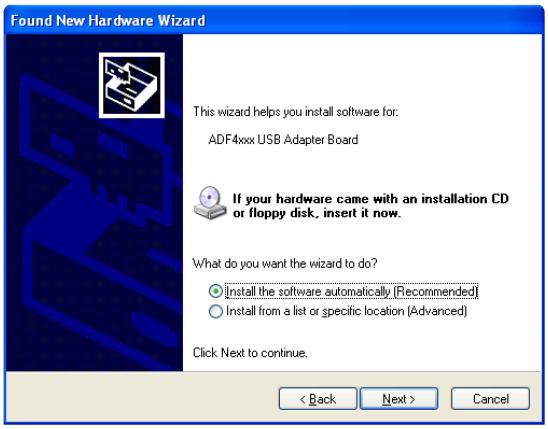
Found New Hardware Wizard
This wizard helps you install software for:
ADF4xxx USB Adapter Board
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel
10676-016

Figure 16. Windows XP USB Driver Installation, Install Options

2. Click **Next**.

Note that Figure 16 may list **Analog Devices RFG.L Eval Board** instead of **ADF4xxx USB Adapter Board**.

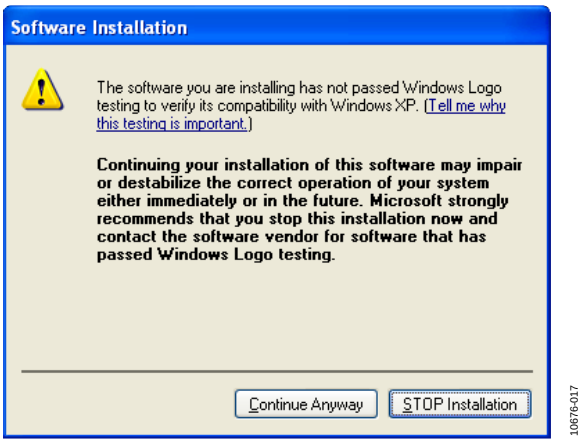
Software Installation
The software you are installing has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the software vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation
10676-017

Figure 17. Windows XP USB Driver Installation, Logo Testing

3. Click **Continue Anyway**.

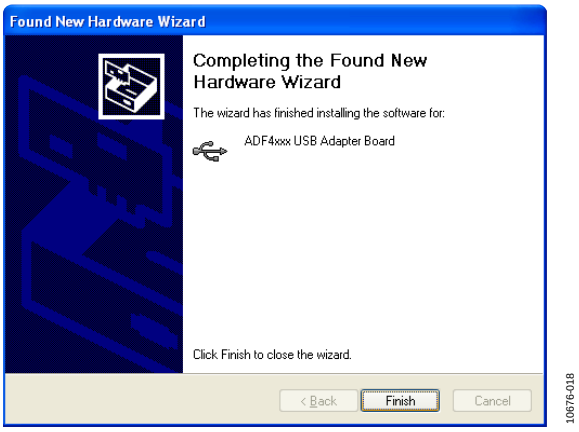

Figure 18. Windows XP USB Driver Installation, Complete Installation

4. Click **Finish**.

EVALUATION BOARD SOFTWARE

The control software for the EVAL-ADF4150HVEB1Z is available on the CD included in the evaluation kit. To install the software, see the Software Installation section.

To run the software, first connect the board to the USB port of the PC and then click the **ADF4150HV** file on the desktop or in the **Start** menu (note that the revision number may be included in the file name). Confirm that **USB OK** is displayed at the top right corner of the software front panel display window (see Figure 19). Otherwise, the software has no connection to the evaluation board.

Note that, when connecting the board, it takes about 5 sec to 10 sec for the status label to change.

If the software is started before the board is connected to USB port, an error window opens, informing that the USB device was not found, and the **No USB** message is displayed in the top right corner of the software front panel window. In this case, connect the board to the USB port and click the **Connect USB** button.

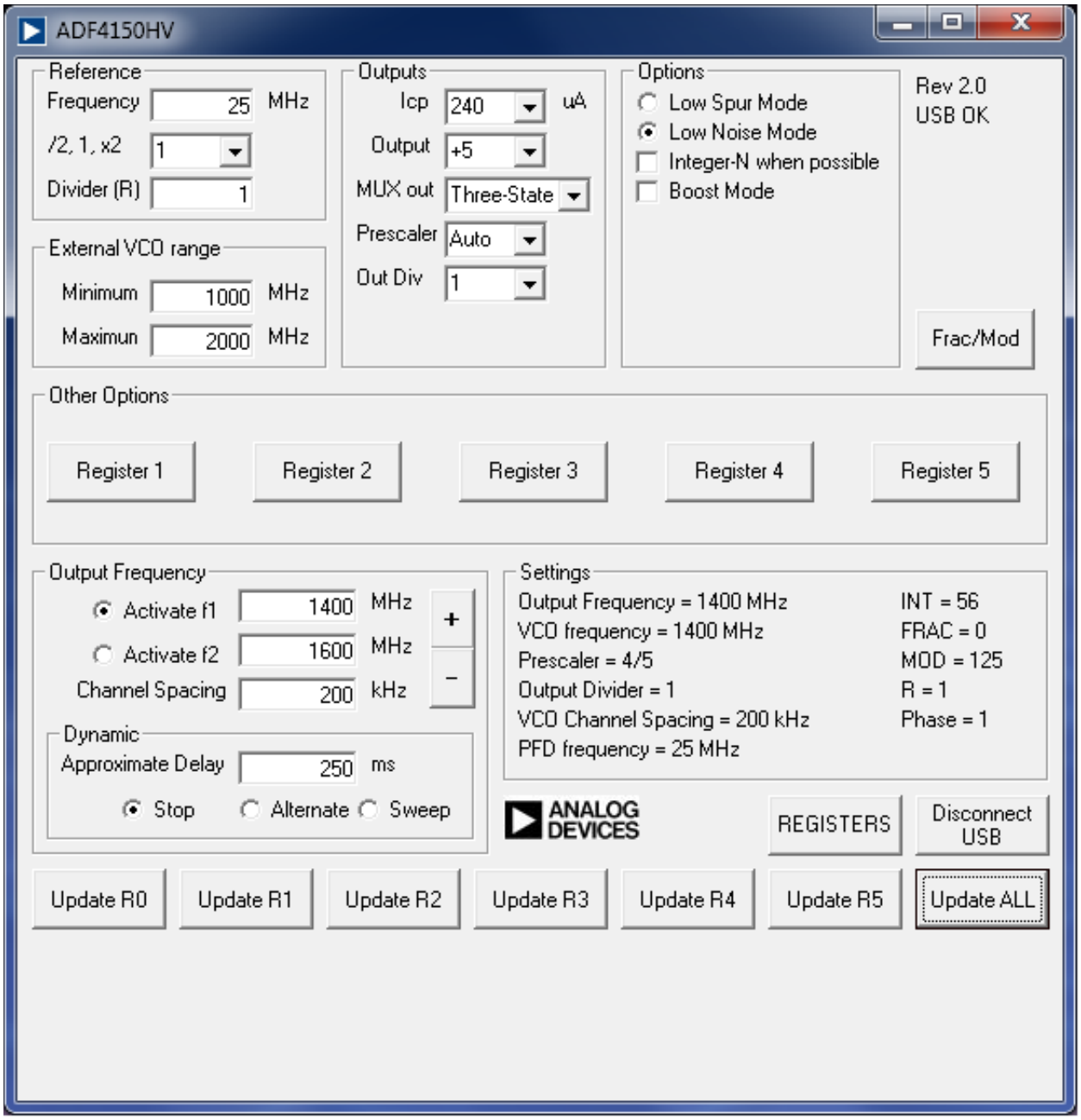

Figure 19. Software Front Panel Display

Use the **Frequency** text box in the **Reference** section to set the correct reference frequency. The default reference on the software window is at 25 MHz and matches the frequency of the TCXO present on the board.

Use the **Output Frequency** section to control the output frequency. To achieve single-tone on the RF output, type the desired output frequency in the **Activate f1** text box (in megahertz) and ensure that **Stop** is selected in the **Dynamic** section under **Output Frequency**. Selecting the **Alternate** option causes the frequency on the VCO output to switch between the **Activate f1** and **Activate f2** values. The delay time between frequency switches is controlled by the **Approximate Delay** option. The third option of the **Dynamic** section, **Sweep**, allows the output frequency to constantly change with the frequency step set by **Channel Spacing** starting from **Activate f1** until it reaches **Activate f2**. When the **Activate f2** frequency is reached, the sweep is repeated. Note that the **Sweep** option is not allowed if the **Activate f1** and **Activate f2** frequencies require different settings for the output divider (the **Out Div** box in the **Outputs** section). However, the **Alternate** option allows both frequencies to be achieved with different output divider values.

Some register settings may need to be set manually. Click the **Register 1** to **Register 5** buttons to open the register settings windows (see Figure 20).

Click the **REGISTERS** button to display the binary and hexadecimal values for all registers, as shown in Figure 22.

When a new register setting value is entered (see Figure 20), the relevant **Update Rx** (where x = 0 to 5) button becomes red, indicating that it must be clicked to program the part with the new value. Clicking the **Update ALL** button programs all register values simultaneously.

Click the **OK** button to confirm the new value in the **Register x Settings** (where x = 1, 2, 3, 4, or 5) window (see Figure 20). Click **Update Rx** to program the part with the new value. The new value is retained in the **Register x Settings** window if it is opened again.

If the value entered is outside of the range specified in the ADF4150HV data sheet, an error message appears and the field is automatically updated to the lowest or highest value within the allowed range. Some limits are changed dynamically based on the values of other registers; for example, the highest allowed value for **Phase** in the **Register 1 Settings** window depends on current value of the modulus (**MOD** in the **Settings** section), which is calculated based on the data from the **Reference** section and the **Channel Spacing** box in the **Output Frequency** section.

Click the **Cancel** button to abandon a register value change, and the new value is not retained in the **Register x Settings** window if it is opened again.

By clicking the **Frac/Mod** button, you can choose different modes of operation, including programming of specified integer, modulus, fractional, and output divider values. The output frequency and channel spacing are calculated automatically when the values shown in Figure 21 are entered in the **Frac_Mod_Form** window.

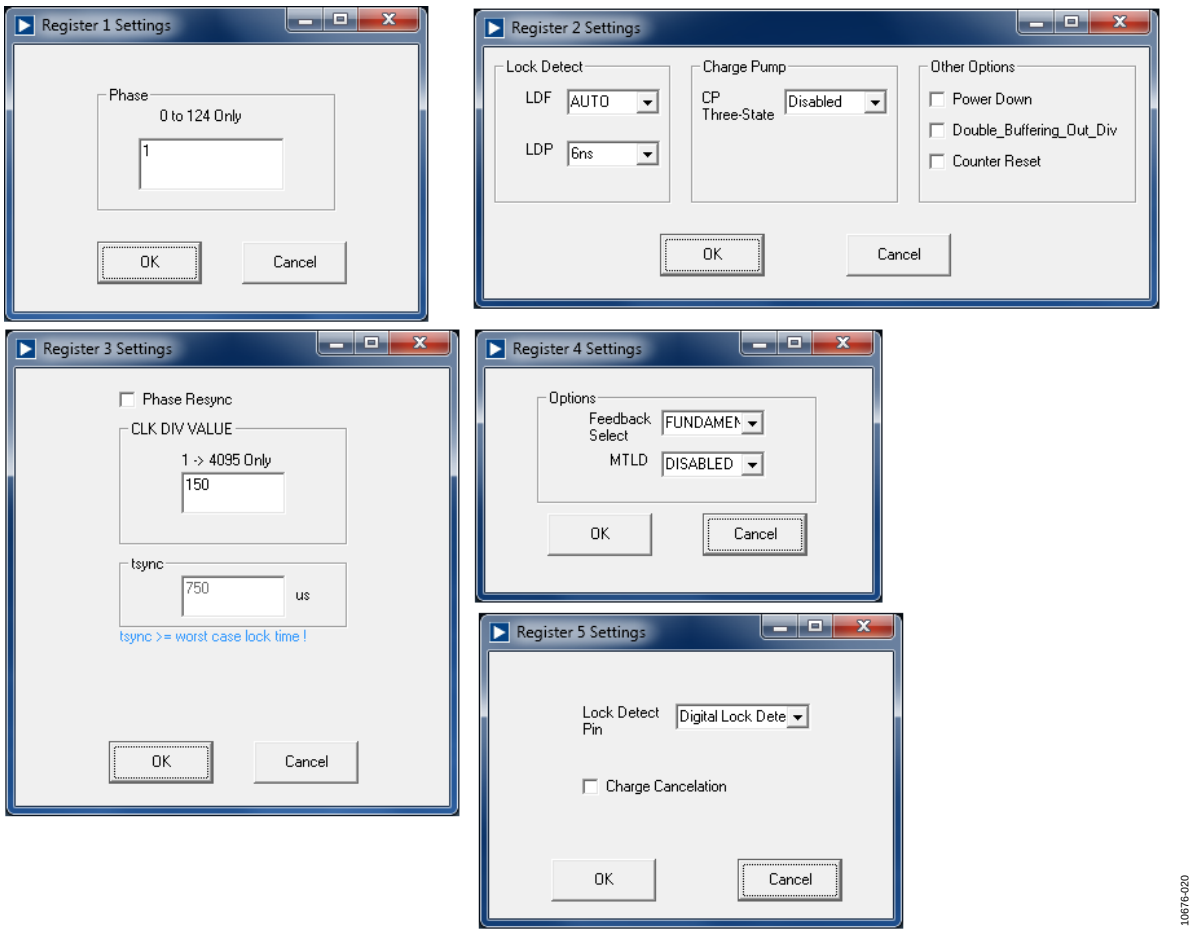

Figure 20. Register Settings Windows for Register 1, Register 2, Register 3, Register 4, and Register 5

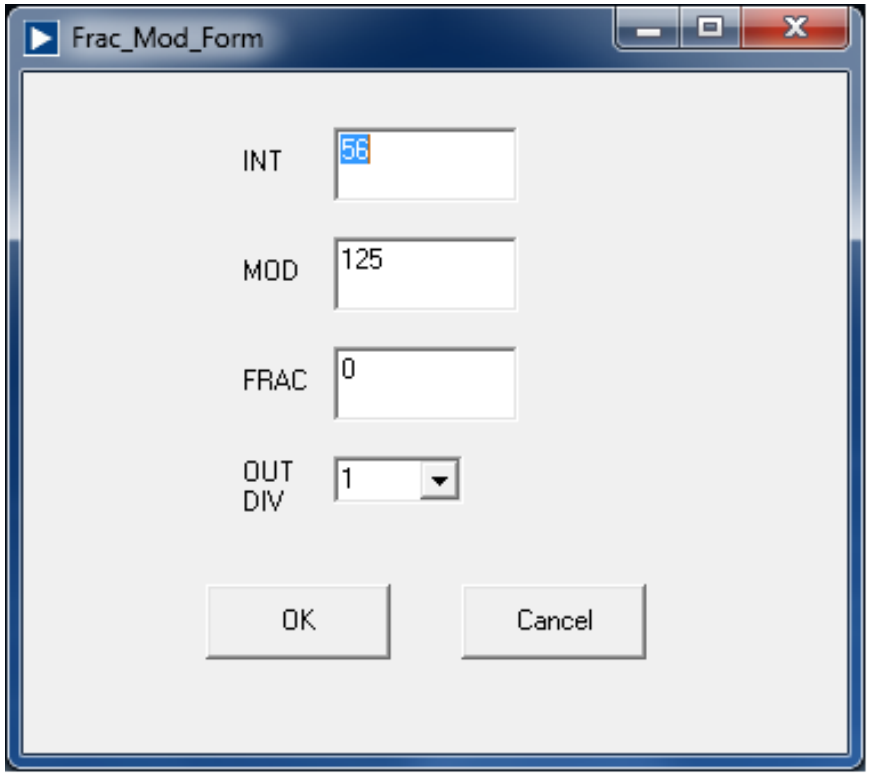

Figure 21. Frac_Mod_Form Window Allows Direct Control of Integer, Modulus, Fractional, and Output Divider Values

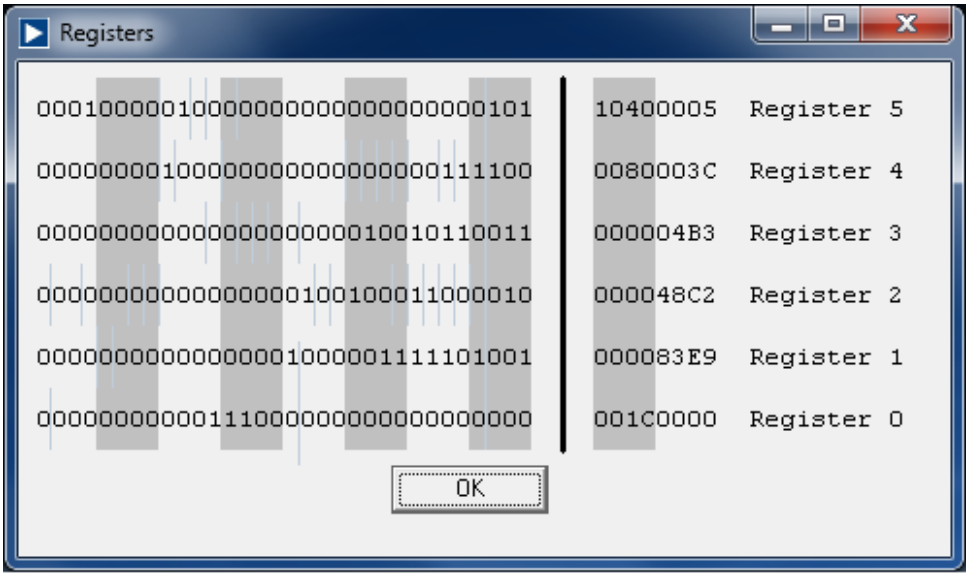

Figure 22. Registers Window Shows Current Values of All Registers of the Part

EVALUATION AND TEST

To evaluate and test the performance of the ADF4150HV, use the following procedure:

1. If using a different VCO and loop filter than provided on the board, ensure that a VCO and loop filter are properly inserted on the board. If a microwave VCO is going to be used together with the ADF5001 prescaler, move Jumper LK1 into Position B to power up the prescaler. Use ADIsimPLL to generate the loop filter component values.
2. Install the ADF4150HV software. Connect the evaluation board to a PC using the supplied USB cable. Follow the hardware driver installation procedure that appears.
3. If the on-board crystal oscillator is used, skip this step. If an external reference is necessary, connect a reference signal to the REFIN edge mount connector.
4. Connect the power supply to the board.
5. Connect a spectrum analyzer to Connector VCO_I/O.
6. Run the ADF4150HV software.
7. In the software window, set the RF output center frequency (Figure 23 shows a screenshot of the signal source analyzer operating in phase noise mode, taken at a frequency of 1.4 GHz). Set the PFD frequency as defined in ADIsimPLL, and program the reference frequency to 25 MHz if the on-board TCXO is used or to the frequency that has been supplied to the REFIN connector. See Figure 24 for the suggested setup.
8. Measure the output spectrum. Figure 23 shows a 1.4 GHz output.

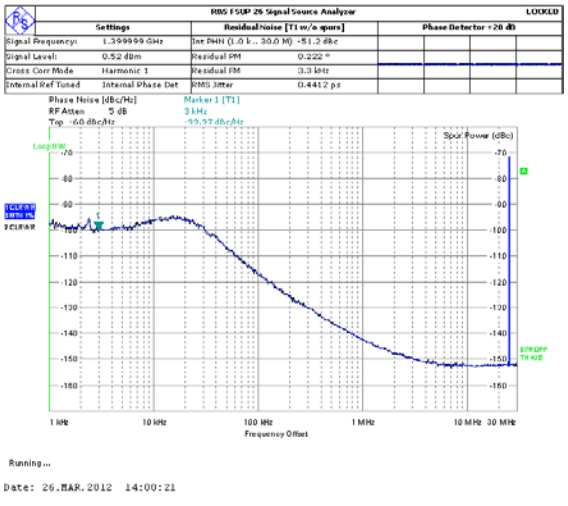

Figure 23. Signal Source Analyzer Display

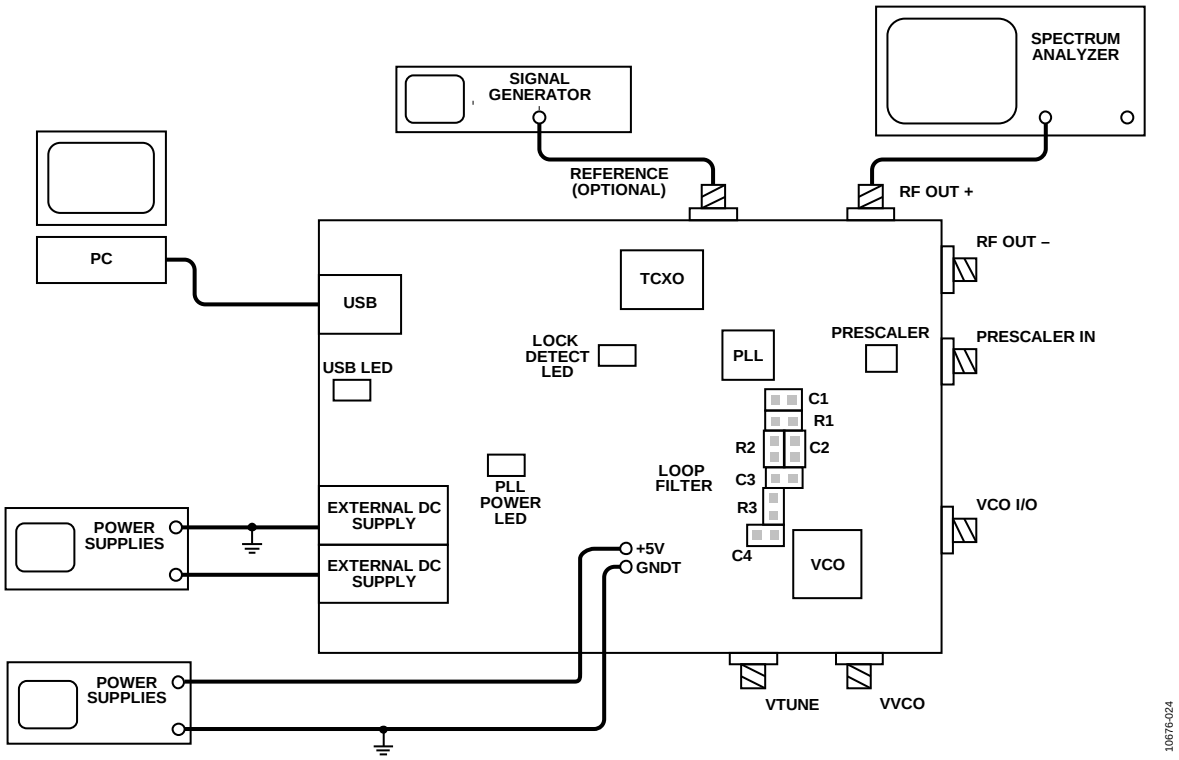

Figure 24. Typical Evaluation Setup

EVALUATION BOARD SCHEMATICS AND ARTWORK

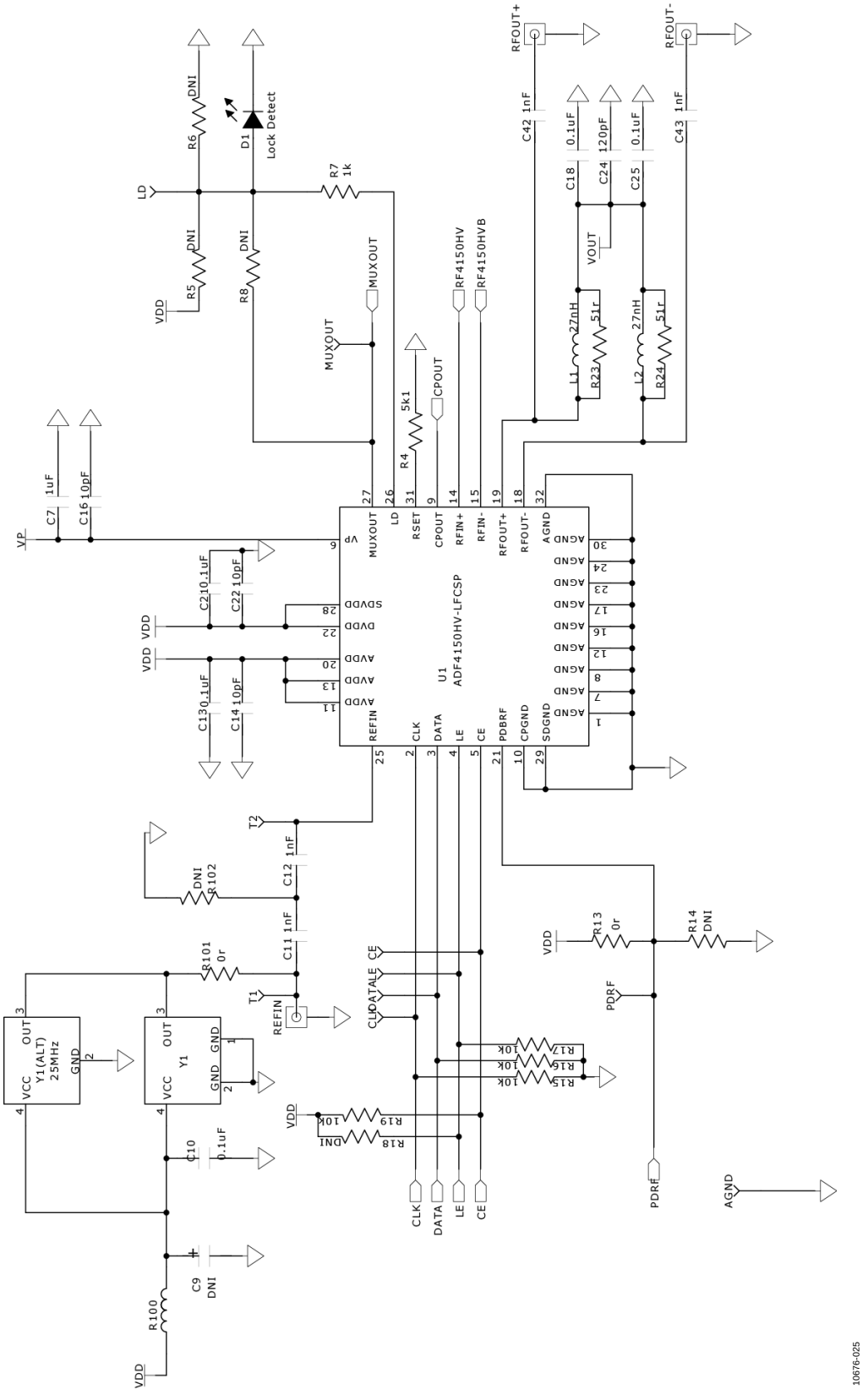

Figure 25. Evaluation Board Schematic (Page 1)

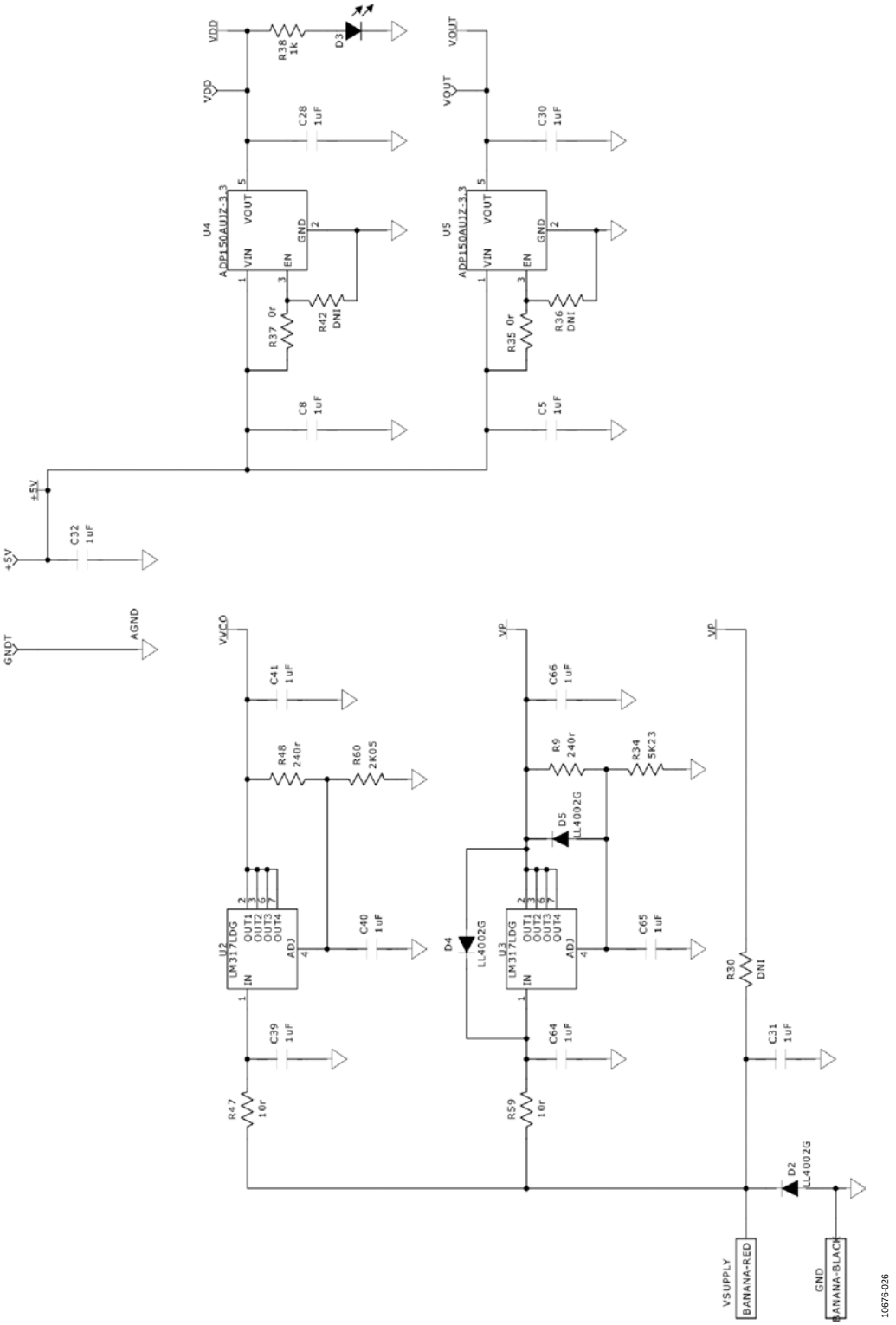

Figure 26. Evaluation Board Schematic (Page 2)

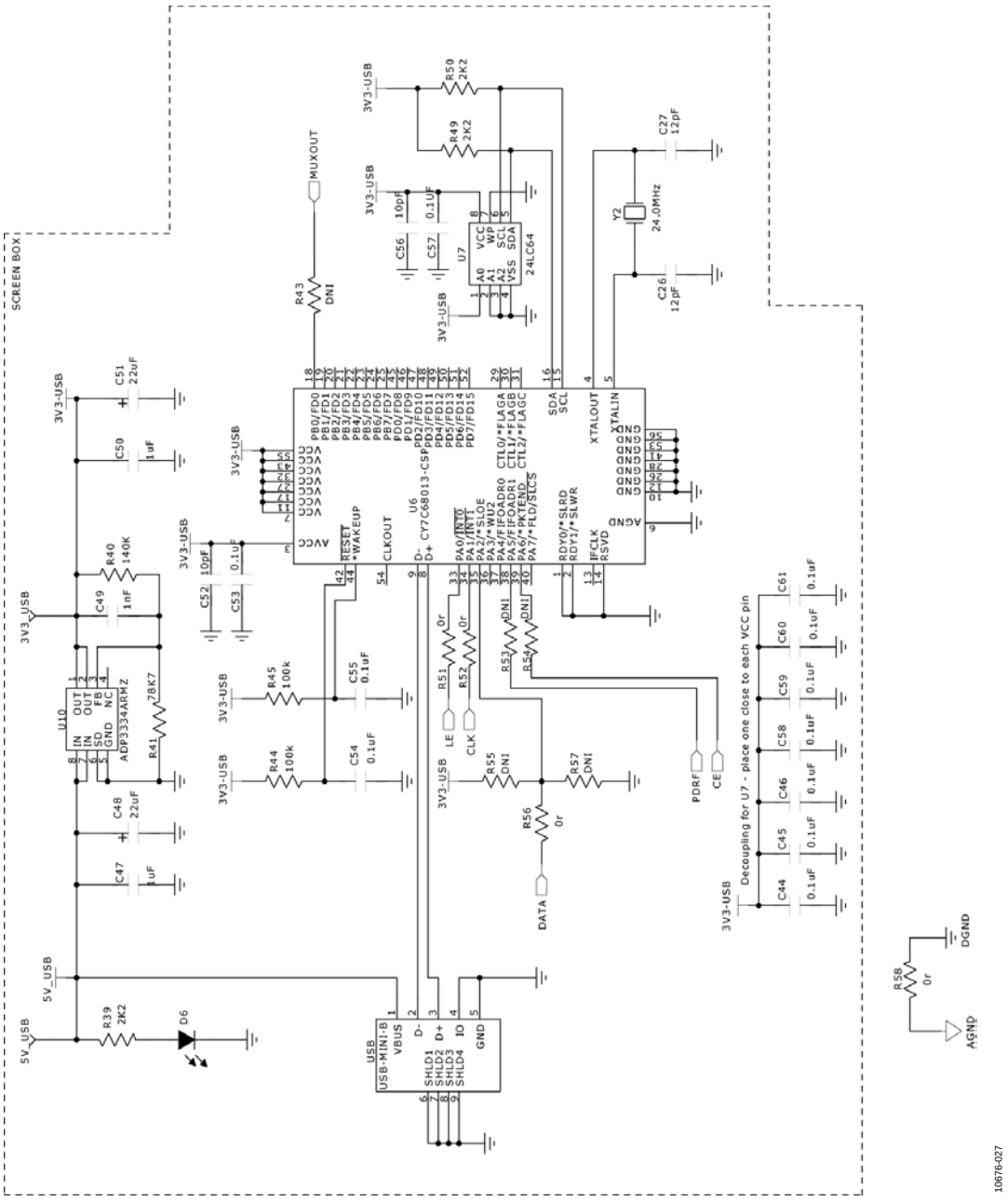

Figure 27. Evaluation Board Schematic (Page 3)

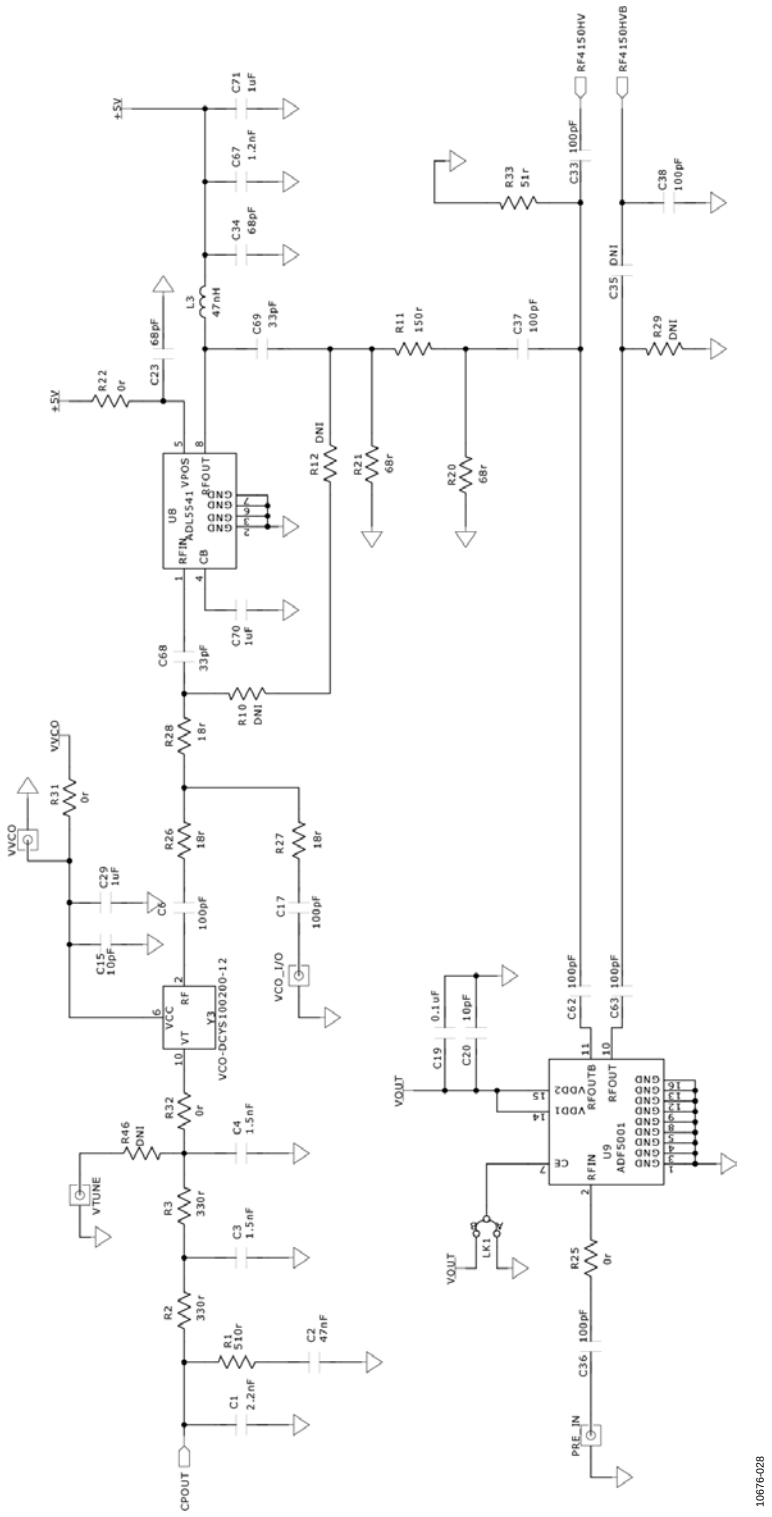

Figure 28. Evaluation Board Schematic (Page 4)

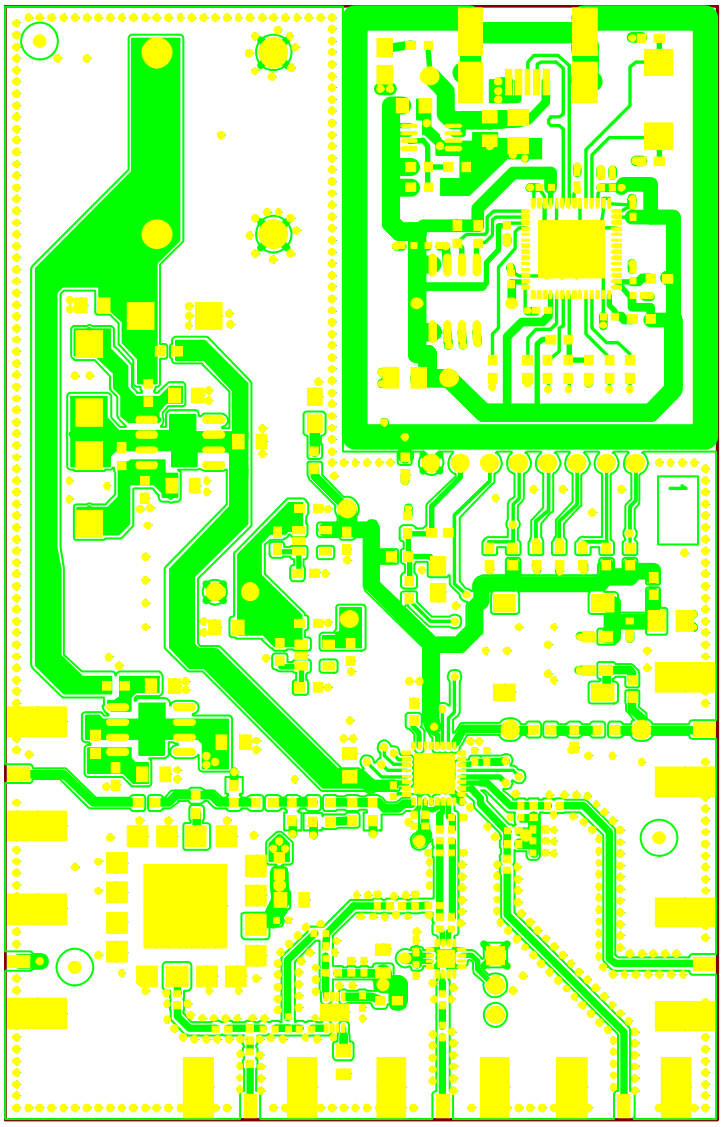

Figure 29. Layer 1 (Component Side)

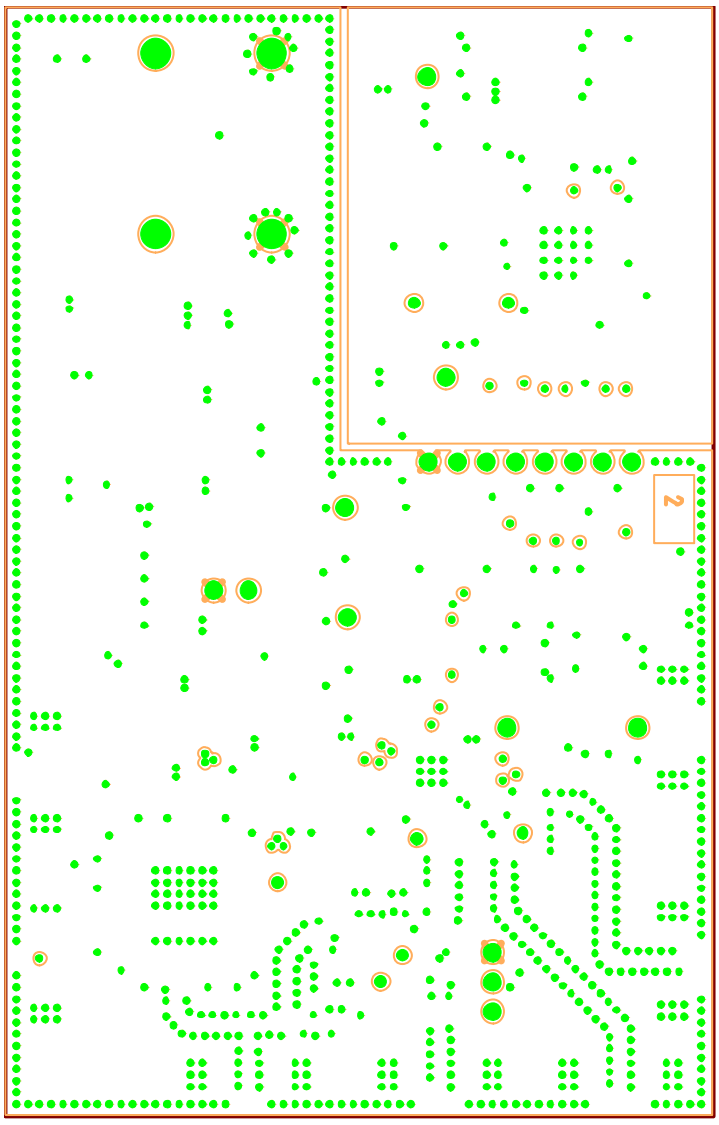

Figure 30. Layer 2 (Ground Plane)

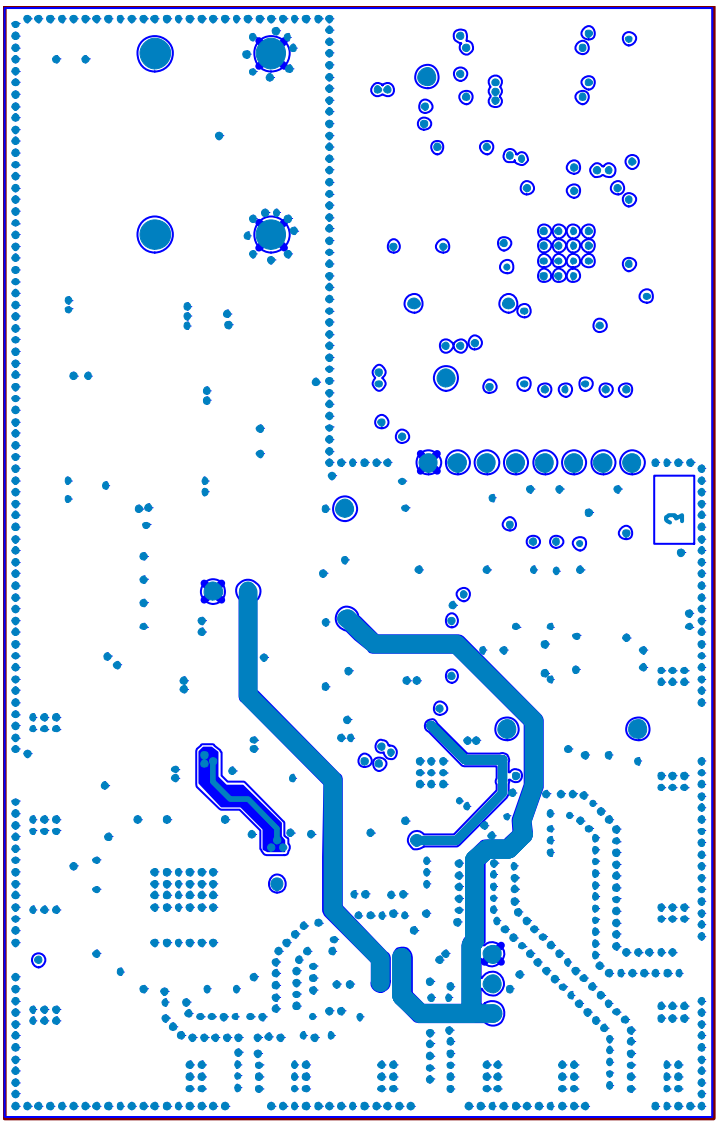

Figure 31. Layer 3 (Power Plane)

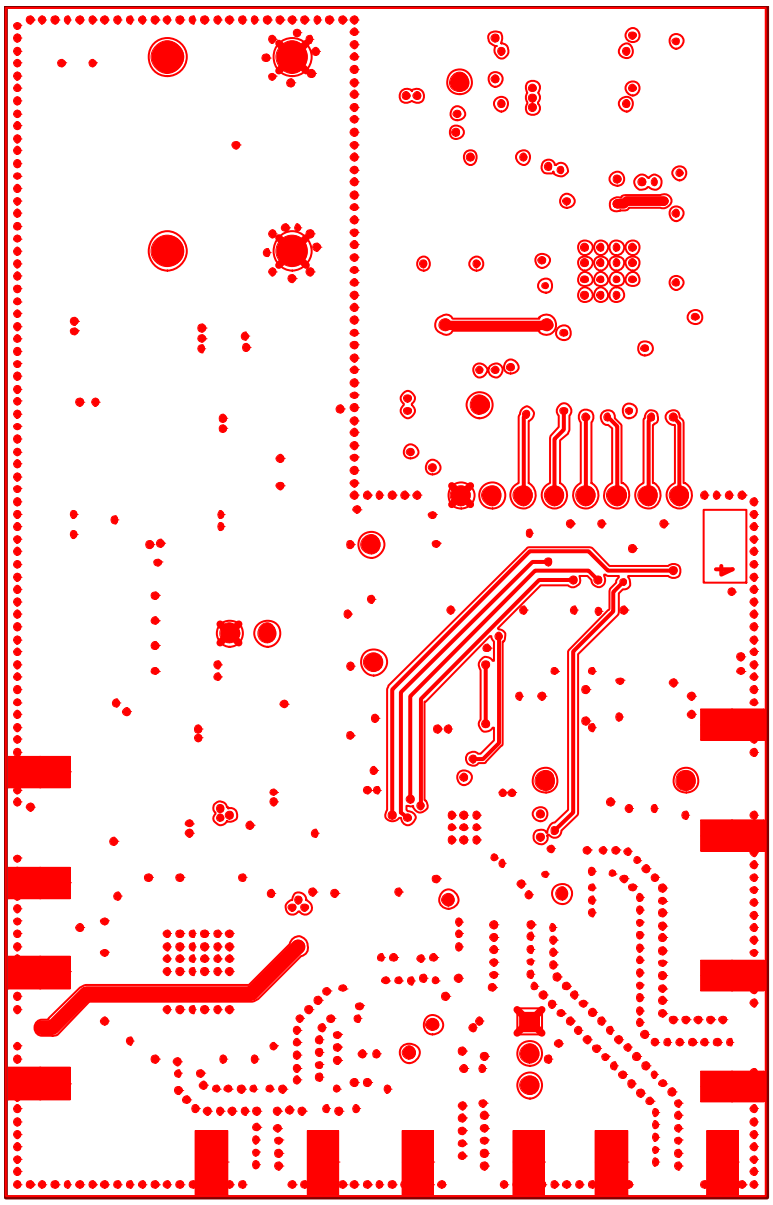

Figure 32. Layer 4 (Solder Side)

BILL OF MATERIALS

Table 1.

Reference Designator	Value	Description	Manufacturer/Part Number
+5V		Red test point	Vero 20-313137
3V3_USB, 5V_USB	Do not insert	Red test point	N/A
AGND		Black test point	Vero 20-2137
C1	2.2 nF	50 V X7R SMD ceramic capacitor	Multicomp MCCA000229
C2	47 nF	50 V X7R SMD ceramic capacitor	Multicomp MCCA000249
C3, C4	1.5 nF	50 V X7R SMD ceramic capacitor	Multicomp MCCA000227
C5, C8, C28, C30	1 µF	Capacitor, 0603 1 µF 10 V X5R	Murata GRM188R61A105KA61D
C6, C17, C33, C36, C37, C38, C62, C63	100 pF	50 V C0G ceramic capacitor	Murata GRM1555C1H101JD01D
C7, C29, C31, C32, C39, C40, C41, C64, C65, C66, C70, C71	1 µF	50 V X5R 0805 1.0 µF ceramic capacitor	Taiyo/Yuden GRM32RR71H105KA01L
C9	Do not insert	TAJ-A capacitor location, not inserted	N/A
C10, C13, C18, C19, C21, C25, C44, C45, C46, C53, C54, C55, C57, C58,C59, C60, C61	0.1 µF	16 V, X7R ceramic capacitor	Kemet C0402C104K4RAC
C1, C12, C49	1 nF	50 V NP0 ceramic capacitor	AVX 06035A102JAT2A
C14, C15, C16, C20, C22, C52, C56	10 pF	50 V NPO ceramic capacitor	AVX 04025U100GAT2A
C23, C34	68 pF	50 V C0G ceramic capacitor	Murata GRM1555C1H680JZ01D
C24	120 pF	50 V NP0 ceramic capacitor	AVX 04025A121JAT2A
C26, C27	12 pF	50 V NPO SMD ceramic capacitor	Phycomp 2238 867 15129
C35	Do not insert	0402 capacitor location , not inserted	N/A
C42, C43	1 nF	Capacitor ceramic 1000 pF 50 V C0G 0402	Murata GRM1555C1H102JA01D
C47, C50	1 µF	Capacitor ceramic 1.0 µF 50 V X5R 0805	Taiyo/Yuden TMK107BJ105KA-T
C48, C51	22 µF	6.3 V tantalum capacitor (TAJ-A case)	AVX TAJA226K006R
C67	1.2 nF	50 V X7R ceramic capacitor	Murata GRM155R71H122KA01D
C68, C69	33 pF	50 V C0G ceramic capacitor	Murata GRM1555C1H330JZ01D
CE, CLK	Do not insert	Red test point	N/A
D1, D6		Green LED	Avago Technologies, HSMG-C170
D2, D4, D5	LL4002G	Power rectifier diode	Multicomp LL4002G
D3		Red LED	Avago Technologies HSMS-C170
DATA	Do not insert	Red test point	N/A
GND		Black 4 mm banana socket	Deltron 571-0100-01
GNDT		Black test point	Vero 20-2137
L1, L2	27 nH	Coilcraft 0402CS SMD inductor	Coilcraft 0402CS-27NX-LU
L3	47 nH	Coilcraft 0402CS SMD inductor	Coilcraft 0402CS-47NX-LU
LD, LE, MUXOUT, PDBRF	Do not insert	Red test point	N/A
LK1		3-pin SIL header and shorting link	Harwin M20-9990345 & M7567-05
PRE_IN		End-launch 50 Ω SMA jack	Emerson Network 142-0701-851
R1	510 Ω	SMD resistor	Multicomp MC 0.063W 0603 510r
R2, R3	330 Ω	SMD resistor	Multicomp MC 0.063W 0603 330R
R4	5.1 kΩ	SMD resistor	Multicomp MC 0.063W 0603 5k1
R5, R6, R8, R14, R18, R30, R36, R42, R43 R46, R53, R54, R55, R57,R102	Do not insert	0603 resistor location, not inserted	N/A
R7, R38	1 kΩ	SMD resistor	Multicomp MC 0.063W 0603 1K
R9, R48	240 Ω	SMD resistor	Multicomp MC 0.063W 0603 240R
R10, R12, R29	Do not insert	0402 resistor location, not inserted	N/A
R11	150 Ω	0402 SMD resistor	Multicomp MC 0.0625W 0402 1% 150R

Reference Designator	Value	Description	Manufacturer/Part Number
R13, R22, R31, R32, R35, R37, R51, R52, R56, R58, R101	0 Ω	SMD resistor	Multicomp MC 0.063W 0603 0R
R15, R16, R17, R19	10 kΩ	SMD resistor	Multicomp MC 0.063W 0603 10K
R20, R21	68 Ω	SMD resistor	Multicomp MC 0.0625W 0402 1% 68R
R23, R24	51 Ω	SMD resistor	Multicomp MC 0.063W 0402 51R
R25	0 Ω	0402 SMD resistor	Multicomp MC 0.0625W 0402 1% 0R
R26, R27, R28	18 Ω	0402 SMD resistor	Multicomp MC 0.0625W 0402 1% 18R
R33	51 Ω	0402 SMD resistor	Multicomp MC 0.063W 0402 51R
R34	5.23 kΩ	SMD resistor	Multicomp MC 0.063W 0603 5K23
R39, R49, R50	2.2 kΩ	SMD resistor	Multicomp MC 0.063W 0603 2k2
R40	140 kΩ	SMD resistor	Multicomp MC 0.063W 0603 1% 140K
R41	78.7 kΩ	SMD resistor	Multicomp MC 0.063W 0603 1% 78K7
R44, R45	100 kΩ	SMD resistor	Multicomp MC 0.063W 0603 100K
R47, R59	10 Ω	SMD resistor	Multicomp MC 0.063W 0603 10R
R60	2.05 kΩ	SMD resistor	Multicomp MC 0.063W 0603 2K05
R100	470 Ω at 100 MHz	Ferrite bead	Wuerth Elektronik 7427-92642
REFIN, RFOUT+, RFOUT−		End-launch 50 Ω SMA jack	Emerson Network 142-0701-851
T1, T2	Do not insert	Red test point	N/A
U1		PLL	Analog Devices ADF4150HVBCPZ
U2, U3		Positive voltage regulator; adjustable	On Semiconductor LM317LDG
U4, U5		3.3 V linear regulator	Analog Devices ADP150AUJZ-3.3
U6		USB microcontroller	Cypress Semiconductor CY7C68013A-56LFXC
U7		64 k I^2C serial EEPROM	Microchip Technology 24LC64-ISN
U8		50 MHz to 6 GHz RF/IF gain block	Analog Devices ADL5541ACPZ
U9		4 GHz to 18 GHz divide-by-4 prescaler	Analog Devices ADF5001BCPZ
U10		Adjustable LDO regulator	Analog Devices ADP3334ARMZ
USB		USB Mini-B connector (USB-OTG)	Molex 54819-0578
VCO_I/O, VTUNE, VVCO		End-launch 50 Ω SMA jack	Emerson Network 142-0701-851
VDD, VOUT	Do not insert	Red test point	N/A
VSUPPLY		Red 4 mm banana socket	Deltron 571-0500-01
Y1 (ALT)	25 MHz	SMD temperature compensated crystal oscillator	Rakon TXO225B
Y2	24 MHz	SMD crystal	ECS International ECS-240-12-20A-TR
Y3	1000 MHz to 2000 MHz	VCO	Synergy Microwave Corp. DCYS100200-12

RELATED LINKS

Resource	Description
ADF4150HV	Product Page, Fractional-N/Integer-N PLL Synthesizer
ADP150	Product Page, Ultralow Noise, 150 mA CMOS Linear Regulator
ADP3334	Product Page, High Accuracy Low I_Q, 500 mA anyCAP® Adjustable Low Dropout Regulator
ADL5541	Product Page, 50 MHz to 6 GHz RF/IF Gain Block, Gain of 15 dB
ADF5001	Product Page, 4 GHz to 18 GHz Divide-by-4 Prescaler

NOTES

I^2C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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